XLV. *Experiments in an heated Room. By* Matthew Dobſon, *M. D. In a Letter to* John Fothergill, *M. D. F. R. S.*

DEAR SIR, Liverpool, April 25, 1775.

Redde, June 22, 1775. I PERUSED with particular pleaſure, your ſhort account of the curious experiment made by Mr. BANKS and Dr. SOLANDER. The ſame, and ſome additional experiments, have been made here; the reſult of which I ſhould ſooner have tranſmitted to you, had I not been prevented by the conſtant engagements of my profeſſion.

EXPERIMENTS.

I. The ſweating-room of our Public Hoſpital at LIVERPOOL, which is nearly a cube of nine feet, lighted from the top, was heated till the quickſilver ſtood at 224° on FAHRENHEIT's ſcale, nor would the tube of the thermometer indeed admit the heat to be raiſed higher. The thermometer was ſuſpended by a ſtring fixed to the wooden frame of the ſky-light, and hung down about the centre of the room. Myſelf and ſeveral others were at this time incloſed in the ſtove, without experiencing any oppreſſive or painful ſenſation of heat, proportioned to the degree pointed out by the thermometer. Every metallic about us ſoon became very hot.

II. My friend Mr. PARK, an ingenious ſurgeon of this place, went into the ſtove heated to 202°. After ten minutes, I found the pulſe quickened to 120°. And to determine the increaſe of the animal heat, another thermometer was handed to him, in which the quickſilver already ſtood at 98°; but it roſe only to 99½, whether the bulb of the thermometer was incloſed in the palms of the hands, or received into the mouth (a). The natural ſtate of this gentleman's pulſe is about 65.

III. Another gentleman went through the ſame experiment in the ſame circumſtances, and with the ſame effects.

IV. One of the porters to the Hoſpital, a healthy young man, and the pulſe 75, was incloſed in the ſtove when the quickſilver ſtood at 210°; and he remained there, with little inconvenience, for twenty minutes. The pulſe, now 164, and the animal heat, determined by another thermometer as in the former experiments, was 101½.

V. A young gentleman of a delicate and irritable habit, whoſe natural pulſe is about 80, remained in the ſtove ten minutes when heated to 224°. The pulſe roſe to 145, and the animal heat to 102°. This gentleman, who had been frequently in the ſtove during the courſe of the day, found himſelf feeble, and diſpoſed to break out into ſweats for 24 hours after the experiment.

(a) The ſcale of the thermometer, which was ſuſpended by the ſtring about the middle of the room, was of metal; this was the only one I could then procure, on which the degrees ran ſo high as to give any ſcope to the experiment. The ſcale of the other thermometer, which was employed for aſcertaining the variations in the animal heat, was of ivory.

V. Two

VI. Two ſmall tin veſſels, containing each the white of an egg, were put into the ſtove heated to 224°. One of them was placed on a wooden ſeat near the wall, and the other ſuſpended by a ſtring about the middle of the ſtove. After ten minutes, they began to coagulate; but the coagulation was ſenſibly quicker and firmer in that which was ſuſpended, than in that which was placed on the wooden ſeat. The progreſs of the coagulation was as follows: it was firſt formed on the ſides, and gradually extended itſelf; the whole of the bottom was next coagulated; and laſt of all the middle part of the top.

VII. Part of the ſhell of an egg was peeled away, leaving only the film which ſurrounds the white; and part of the white being drawn out, the film ſunk ſo as to form a little cup. This cup was filled with ſome of the *albumen ovi*, which was conſequently detached as much as poſſible from every thing but the contact of the air and of the film which formed the cup. The lower part of the egg ſtood upon ſome light tow in a common gallipot, and was placed on the wooden ſeat in the ſtove. The quickſilver in the thermometer ſtill continued at 224°. After remaining in the ſtove for an hour, the lower part of the egg which was covered with the ſhell, was firmly coagulated; but that which was in the little cup was fluid and tranſparent. At the end of another hour it was ſtill fluid, except on the edges where it was thinneſt; and here it was ſtill tranſparent; a ſufficient proof that it was dried, not coagulated.

VIII. A piece of bees wax, placed in the ſame ſituation with the *albumen ovi* of the preceding experiment, and expoſed to the ſame degree of heat in the ſtove, began to melt in five minutes: another piece ſuſpended by a ſtring, and a third piece put into the tin veſſel and ſuſpended, began likewiſe to liquify in five minutes.

OBSERVATIONS.

That heated air ſhould have ſuch a ſpeedy and powerful effect in quickening the pulſe, while the animal heat is little altered from its natural ſtandard; that the human body ſhould ſo eaſily bear to be ſurrounded with air heated to 224°; that the *albumen ovi*, which begins to coagulate in water at 150°, ſhould remain fluid in 224°; and that the ſame *albumen ovi*, ſtill placed in air heated to 224°, ſhould coagulate if in contact either with tin or its own ſhell, are facts as ſingular as they are difficult of explanation. From the different effects of heated air on the pulſe and the heat of the body, do we not diſcover the fallacy of that theory of animal heat which has been adopted by BOERHAAVE and other celebrated phyſiologiſts? They ſuppoſe that animal heat is produced by the attrition of the *globules* of the circulating fluids againſt the ſides of the containing veſſels; but in ſeveral of the preceding experiments, the circulation was amazingly quickened with little increaſe of the animal heat. But whence is it that the human body can bear without immediate injury, to be ſurrounded with air heated to 224°? And whence is it, that the *albumen ovi* does not coagulate

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in this degree of heat? Is it that fire as it paſſes into ſome bodies becomes latent, agreeable to a doctrine which has for ſome time been taught at Edinburgh by Profeſſor BLACK? Or does fire become fixed and *quieſcent*, according to a ſimilar ſyſtem adopted by Dr. FRANKLIN (*b*)? Air we know exiſts either in a fixed or elaſtic ſtate; and fire may in like manner exiſt in bodies, either in a latent, fixed, and *quieſcent*; or in a ſenſible, fluid, and active ſtate. Agreeable to this idea, the bees wax receives the fire in an active ſtate, and diſſolves; while the human body and the *albumen ovi*, receiving the fire in a latent ſtate, are little altered in their temperature. Let each of theſe, however, be put in contact with a different body, tin for inſtance; and though the heat of the air continues the ſame, yet the fire no longer enters in a latent ſtate, but with all its ſenſible and active powers; for the *albumen ovi* ſuſpended in a tin veſſel ſoon coagulates; and the human body, covered with the ſame metal, would quickly experience an intolerable and deſtructive degree of heat. Or are the above phænomena more ſatisfactorily explained, by conſidering different bodies as poſſeſſing different conducting powers; ſome being ſtrong, others weak conductors of fire? All thoſe bodies then which are weak conductors of fire from air, may be placed in air, without receiving the heat of this medium. Hence the *albumen ovi* remains fluid in air heated to 224°. Hence likewiſe the frog, the lizard, the camelion, &c. retain their natural temperature, and feel cold

(*b*) Exper. and Obſerv. p. 346. and 412.

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to the touch, though perpetually ſurrounded with air hotter than their own bodies. Hence alſo, the human body keeps nearly its own temperature, in a ſtove heated to 224°: or may even paſs without injury into air heated to a much greater degree, according to the obſervations of DU HAMEL and TILLETT, publiſhed in the Memoirs of the Academy of Sciences (c). On the other hand, all thoſe bodies which are powerful conductors of fire from air, are influenced in proportion when ſurrounded with this medium. The bees wax melted from the mere contact of the air in experiment VIII; and in experiment VI, the *albumen ovi* was coagulated on the intervention of another body, which is a ſtrong conductor of fire from air. But whether this method of reaſoning on the natural cauſe of theſe effects be juſt or not, the final cauſe is obvious, and is to be reſolved into the wiſe and benevolent appointment of the Almighty. Man is happily ſo framed, as to poſſeſs a power of keeping nearly the ſame tenor of heat, in all the variations of the temperature of the air in ſummer and in winter, in hot and cold climates; and conſequently changes his ſituation on the ſurface of the globe, with much leſs inconvenience or injury, than he could otherwiſe have done. The ſame power likewiſe happily adapts different animals to their reſpective deſtinations. The lizard and the camelion remain cool under the Equator, while the whale and porpoiſe retain a degree of heat above that of the human body, though ſurrounded with the waters of the coldeſt

(c) Memoires pour 1761.

Northern ſeas, and amidſt mountains of ice in the neighbourhood of the Pole.

Should you think theſe experiments and obſervations on heated air of ſufficient importance to be communicated to the Royal Society, they are at your diſpoſal.

I have the pleaſure to find, that Dr. PRIESTLEY is proſecuting his very ingenious inquiries on air. In a letter I lately received from him, he informs me, that he has diſcovered a ſpecies of air, which will preſerve animal life ſix times longer than atmoſpheric air.

I remain, with great eſteem, &c.